UPDATE 1992

ONTARIO HYDRO'S PLAN TO SERVE CUSTOMERS' ELECTRICITY NEEDS

PROVIDING THE BALANCE OF POWER

Providing the Balance of Power

On the cover is a design with the words: "Providing the Balance of Power." Within the design are a sphere and a cube, balanced by a pyramid.

These shapes symbolize the three activities involved in Ontario Hydro's Demand/Supply Plan to provide electrical energy to the people of Ontario for the next 25 years.

The three activities are:

Assessing Needs

Electricity will be expected to provide a range of services in home, work, recreation and community life. Planning must assess needs and compare them to resources.

Defining Resources

Resources are the existing facilities and the future options available to meet customer needs.

Making Plans

As needs grow and existing resources decline, plans must add the right amount of new resources to maintain the balance.

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UPDATE

1992

I SUMMARY

This book describes the features of the 1992 UPDATE to Ontario Hydro's 25 year Demand/Supply Plan to serve customers' electricity needs. It reflects Hydro's continuing commitment to electricity service which is reliable and reasonably priced, and reflects concern for the environment.

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Any plan that extends over a 25-year period will have to be updated as circumstances change. In updating the Plan to reflect these changes Hydro follows the same basic planning principles as in the original submission.

The Need for Electricity

The 1989 plan identified a range of forecasts for future electricity growth. The forecast in this update has lower demand for electricity in the short term, reflecting the major downturn in the provincial economy. In the long term, demand for electricity is reduced by efficiency improvements and fuel switching.

Getting More From Priority Options

The 1989 Plan identified a number of priority options for meeting future requirements which remain valid. The top priority remains making the maximum use of demand management. Other priorities are to make the most effective use of the existing system; to encourage the development of non-utility generation (electricity generators in Ontario other than Ontario Hydro) to the extent it is economic and needed to meet future requirements; and to develop economic hydraulic capacity.

More Demand Management

With success to date in an ambitious program to help customers use electricity more efficiently, demand management programs are now anticipated to

provide even greater savings by the end of the planning period. Savings are now forecast to contribute 9,860 megawatts (MW) by 2014, compared to 5,570 MW in the original Plan. This increase in projected savings reflects higher efficiency standards for electrical equipment and additional opportunities resulting from proposed legislation allowing Hydro to promote the use of alternative fuels in applications where electricity is not the most appropriate energy, and when the use of an alternative fuel would provide benefits to customers and to Hydro.

More Use of Existing Facilities

In order to make the best use of the existing system, Ontario Hydro is planning to extend the life of several of its fossil generating plants. This will defer the need for approximately 4,300 MW of new major supply to time periods beyond the 2014 planning horizon. With life extension of fossil stations, it is also planned to install additional environmental control equipment. Even with this equipment it is believed that extending the life of existing fossil units will prove to be economic.

Non-utility Generation (NUG)

In the 1989 Plan, Non-Utility Generators were forecast to provide some 2,120 MW of power by 2014. Due to the rapid development of this industry, the contribution from this source is forecast to increase and Hydro now feels it can, if needed, rely on NUGs to provide up to 4,200 MW by the year 2014 to help meet customer needs.

Adjustments to the Hydraulic Plan

Over the first 60 years of the century, Ontario Hydro has relied on renewable water resources to meet much of the Province's requirements. The 1989 Demand/Supply Plan projected that 2,850 MW of new hydraulic capacity could be economically developed to meet the demand for electricity by the year 2014.

Megawatt (MW): is a unit of measurement for electrical power. The power needs for the city of Hamilton are about 1,000 MW and for Kingston about 100 MW.

Hydro's planning approach identified hydraulic as a priority option. However, since the 1989 Plan, the relationship between the Ontario Government and the First Nations in Ontario, and the relationship between Hydro and aboriginal peoples have evolved.

As a result, Hydro officially suspended planning for six new stations and two extensions to existing stations on the Moose and Abitibi Rivers until a process for co-planning studies related to Hydro developments in that Basin has been agreed to by the affected aboriginal groups.

Primarily as a result of these changes, Ontario Hydro estimates that up to 1,800 MW of additional hydraulic capacity can be relied on for planning to 2014, and approvals are being requested consistent with this estimate.

Major Supply

Ontario Hydro is requesting the approval for the need for the transmission facilities to incorporate electricity purchased from Manitoba. The purchase from Manitoba will provide approximately 1,000 MW starting in 2000.

Approval requests by Hydro to the Province's Environmental Assessment Board for the need for new facilities are based on a five year action plan, defined as those projects for which a project environmental assessment document is expected to be submitted within five years of an Environmental Assessment Board (EAB) decision on the Demand/Supply Plan.

The original Plan submission included requests for approval of the need for two nuclear stations and a number of natural gas-fired combustion turbine units, some of which could be converted to combined cycle or coal gasification units at a later date. As a result of the economic conditions, more demand management, additional economic non-utility

generation, and the extension of fossil station lives, most of the need for major supply now occurs later in the planning period. This is beyond the period for which Hydro is seeking approvals

The Public Review Process

Following the release of the original Demand/Supply Plan, a variety of public feedback activities were carried out across the province. These included information centers, and communications programs with groups, organizations and governments. These activities have informed Hydro about public and governments' comments and concerns. The UPDATE reflects the input by the various parties that have been involved over the course of the electricity planning process.

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The formal mechanism for reviewing the Demand/Supply Plan is the hearing before the Environmental Assessment Board of Ontario.

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Hydro continues to seek approval for the requirement and rationale for transmission associated with the 1,000 MW purchase from Manitoba, and for up to 1,800 MW of hydraulic generation. These approvals for 2,800 MW of new supply represent an investment of approximately $7 billion.

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The issues which will be considered by the EAB will include the appropriate level of demand management and non-utility generation for planning as well as the relative merits of major supply options.

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Ontario Hydro needs to continue to review its plans and, on a periodic basis, adjust these plans to respond to changing circumstances and new information. Recognizing the continuous nature of planning is important both for Hydro and for the ongoing public review of Hydro's plans.

II INTRODUCTION

In 1989, Ontario Hydro released a plan to serve the long-term needs of Ontario's electricity users. The 25-year plan, was described in the document "Providing the Balance of Power." Consultation with communities across the Province, with business and interest groups, and reviews by government gave Hydro feedback of what Ontarians wanted to see as priorities in electricity planning.

From that consultation and review, and from its own planning analysis, Hydro developed several priorities as the foundation of its planning:

- top priority to reducing growth in electricity demand (demand management),
- high priority to getting the most from the existing electricity system,
- high priority to encouraging efficient and economic generation of power by independent electricity producers (non-utility generators),
- high priority to developing the Province's economic hydraulic potential.

In addition, Hydro's planning approach assumed that major supply options for supplying electricity, such as coal, nuclear, and natural gas facilities, are kept open for future development.

FORECASTING FUTURE NEEDS: DEFINING UNCERTAINTY

Electricity planning starts with a forecast of how much electrical power customers will need in the future. Many factors go into making a forecast, such as population and economic growth, the price of different forms of energy, and how efficient future uses of electricity will be.

The farther out in time, the more uncertain forecast will be. Hydro produces a range of predictions (upper, median, and lower) to define the range of uncertainty. (see Figure 1).

The initial or *basic* forecast recognizes developments in our society that could influence the use of electricity such as the growth in the economy, the natural improvement of the energy efficiency of products we use, the degree to which we use electricity rather than other forms of energy, and some general longer term assumptions about future regulations with respect to the environment and energy efficiency standards.

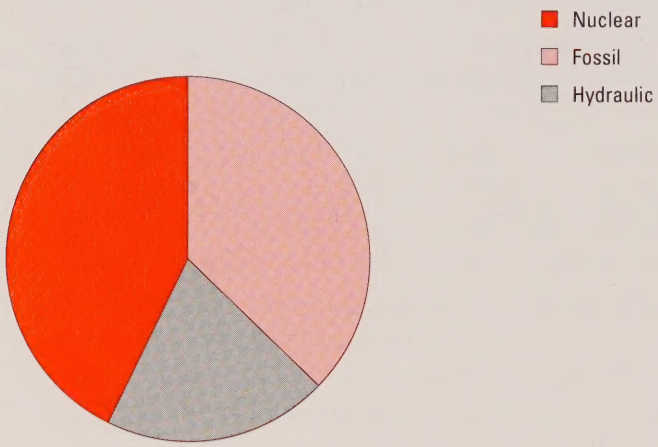
Once the forecast range has been determined, Hydro develops a *primary* forecast which takes into account the effect of electricity savings programs (demand management) designed to slow down growth in demand. It also takes into account the amount of electricity that no

Figure 1 **Range of Uncertainty**

Primary Load Forecast Bandwidth – 1992 Update

GW= gigawatt, or 1,000 megawatts

Figure 2 **The Hydro System in 1993**



longer has to be supplied once non-utility generators start producing their own power.

CAPABILITY OF THE EXISTING SYSTEM

Planning then looks at the capability of the existing electricity system to meet demand over the next 25 years. That projection must take into account any retirements due to aging and/or obsolescence of existing generating stations.

The make-up of Ontario Hydro's existing system is shown in Figure 2. The projected capability of the existing system is measured against the forecast range of future primary electricity demand to determine future requirement and need dates. The need date is where the forecast demand begins to exceed available supply.

THE OPTIONS FOR MEETING FUTURE NEEDS

In an integrated demand/supply plan, future requirements can be met by options either to reduce future growth in demand or by options to increase future supply. The objective is to keep demand and supply in balance in a cost effective and environmentally acceptable way.

Demand Management

Demand management includes activities undertaken by Hydro to help customers save electricity, shift its use from peak times, use it more efficiently, and promote alternative fuels where appropriate. To support this, a wide range of utility programs are available to all types of customers – residential, commercial, agricultural, and industrial.

Demand management measures include:

1. *Electrical Efficiency Improvements (EEI)*: the development and promotion of more energy efficient electrical equipment and conservation measures such as lightbulbs, motors or improved insulation;
2. *Load Shifting (LS)*: incentives to induce customers to use less power during periods when demand is at its peak;
3. *Customer interruptible loads (CIL)*: where industrial customers agree, in return for a lower rate, to reduce their demand to a specified level at certain times on request from Hydro.
4. *Fuel Switching (FS)*: inducing customers to use alternatives to electricity, such as natural gas, where there are benefits to the customer and to Hydro. This form of demand management was not included in the 1989 plan, but is a significant development, discussed in section III.

The objective of demand management programs is to meet customer needs for energy services while using less electricity, or by using another form of energy where appropriarte. Because reducing the growth of future demand defers the need to build and operate new supply facilities, demand management measures can also be environmentally preferable to new supply.

Non-utility Generation

Non-utility generation is electrical generation owned and operated in Ontario by independent generators, such as private and municipal utilities, and independent power producers. The electricity generated can be sold to Hydro or used to meet the producer's own needs.

Non-utility generation uses three different primary forms of energy: falling water; conventional fossil fuels, chiefly natural gas; and waste fuels, such as wood waste, landfill gas (methane), and municipal solid waste.

Figure 3 Technologies for Electrical Efficiency Improvements

	Residential/ Agricultural	Commercial	Industrial
Energy efficient lighting	•	•	•
High efficiency motors	•	•	•
Heat pumps	•	•	•
Energy efficient appliances/equipment	•	•	
Water heater wrap, etc	•	•	
Energy efficient showerheads	•	•	
Building Improvements			
Insulation	•	•	
Weather stripping	•	•	
Window replacements	•	•	
R2000 building standard	•		
Ventilation		•	
Controls/timers	•	•	
Energy efficient design/performance optimization (compressors, fans, pumps)		•	•
Refrigeration		•	•
Energy management systems		•	•
Efficient heating, ventilation, air-conditioning systems		•	•
Agricultural technologies (milk heat reclaimers, heater sizing, heat exchangers)	•		
Energy efficient streetlighting		•	
Energy efficient cooking systems		•	
Individual metering		•	
Industrial drive (turbo expanders, compressed air)			•
Industrial Processes (effluent treatment, furnace efficiency improvements)			•

Configurations of Fossil and Nuclear Stations

Both fossil and nuclear stations can be constructed in various configurations typically from one to four units.

Natural gas-fired facilities tend to be available in smaller units, while conventional coal-fired and nuclear units are typically larger, reflecting better economy of scale for that technology.

Cogeneration is a process in which generators simultaneously produce electricity and process heat for other energy applications in an industrial process. Cogeneration makes efficient use of fuel, thus helping the cogenerator get the most value from the energy input, and improving the competitive position of Ontario industries. Cogeneration can use either fossil fuels such as natural gas or coal, or other sources such as wood waste.

Because of potential environmental and resource use advantages, Ontario Hydro gives preference to the encouragement of non-utility generation which utilizes a renewable energy source like falling water, or burns a waste product, or uses a conventional fuel in high efficiency cogeneration.

Hydraulic Generation

In decades past, the electricity system was built on the availability of hydraulic power from falling water. It is a renewable energy source. Hydraulic facilities are inexpensive to operate, have long life expectancy, and require less maintenance than fossil or nuclear stations. Hydraulic developments also have large capital requirements.

However, most of the economic sites have been developed. Some of the remaining sites are unavailable for development because of regional environmental impacts or competing land and water uses.

Much of the remaining potential is with small to medium sites in northern Ontario, often in land areas where aboriginal people hunt, fish, and trap for their livelihood. The potential available for development must reflect these and other aboriginal interests.

Major Supply Options

A. Fossil Generation

The main fossil energy sources for producing electricity are oil, coal, and natural gas. Natural gas and oil facilities are generally less expensive to build than coal or nuclear plants, but fuelling costs are higher. The main technologies that can be used for fossil generation are:

1. *Conventional Steam Cycle*: fuel such as pulverized coal is fed to a boiler. Combustion takes place in the boiler. Heat is recovered in the boiler through water and steam-cooled tubes, and converted to higher pressure superheated steam. This steam spins a turbine which drives a generator to produce electricity.
2. *Combustion Turbine Units (CTUs)*: may burn natural gas or oil. Fuel is fed directly to the combustion chamber along with high pressure air. The fuel and air are burned, producing hot gases which expand through the turbine blades causing the turbine to rotate at high speed. The turbine drives a generator.
3. *Combined Cycle (CC)*: this technology is made up of combustion turbine units in combination with appropriately sized heat recovery boilers. These convert the heat of the hot exhaust gas from the CTU into steam, which then drives a conventional electrical generator. The fuel can be natural gas or oil.
4. *Integrated Gasification Combined Cycle (IGCC)*: this process takes the combined cycle conversion process one step further by adding a coal gasification plant to permit the use of lower-cost coal as primary fuel. The IGCC process integrates both combined cycle and coal gasification processes, and the development of the facility can be phased so that it can start as a CTU, be developed as a combined cycle fueled by natural gas, or further developed with the addition of a coal gasification plant.

Environmental Emissions and Controls

Burning coal produces air emissions such as sulphur dioxide (SO_2), nitrogen oxides (NO_X), and carbon dioxide (CO_2), as well particulates such as fly ash. SO_2 and NO_X are known to contribute to acid rain, and CO_2 contributes to the greenhouse effect and global warming. Water is used for cooling and for various processes, and solid waste (bottom ash) is produced from the operation of coal stations.

Environmental controls can reduce all but CO_2 emissions. SO_2 emissions can be reduced by burning low sulphur coal, and through the installation of Flue-Gas desulphurization (FGD) also known as scrubbers. Scrubbers are large chemical facilities that work on large volumes of flue gases. The scrubber process also leaves a by-product which can be used as landfill or treated to make wallboard.

NO_X can be reduced with low NO_X burners, combustion process modifications (CPM), or other technologies such as urea injection or Selective Catalytic Reduction (SCRs). With SCRs, nitrogen oxides are reduced to nitrogen and water using anhydrous ammonia and a catalyst. The used catalyst can be recycled.

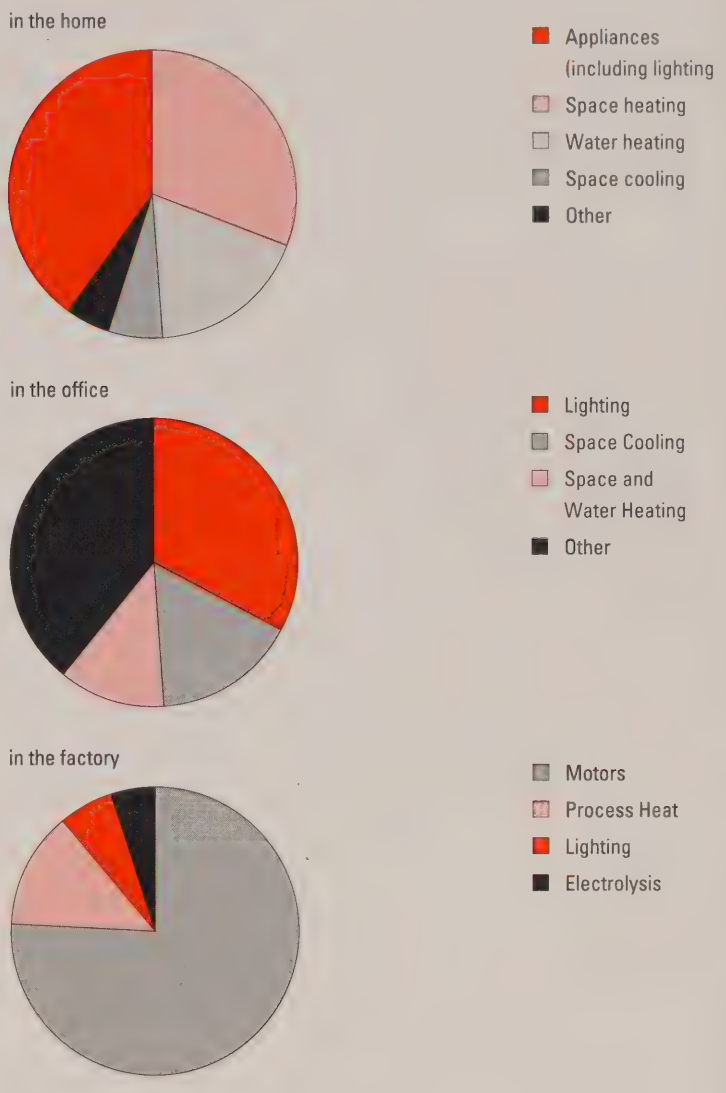
Particulates from the gases produced by combustion can be removed by electrostatic precipitators or fabric filters.

Burning natural gas produces no SO_2 or particulate material, and less CO_2 than from coal combustion. Natural gas combustion does produce NO_X, but less than coal, and SCR or other NO_X controls may be appropriate for facilities that are used frequently.

B. Nuclear Generation

A nuclear reactor and associated steam generator perform the same function as a boiler in a conventional steam cycle plant. Heat is generated by nuclear reaction, and to sustain this reaction

Figure 4 **How Electricity is Used in Ontario (1990)**



the neutrons are slowed down or moderated. In the Canadian CANDU system, the moderator is manufactured heavy water whose use eliminates the need for enriched uranium fuel. The light water design (pressurized water reactor) prevalent elsewhere in the world uses ordinary water but requires enriched fuel.

Environmental Emissions and Controls

Nuclear plants are designed to contain radioactivity with a series of safety barriers including sheathing on the fuel, heat transport system, and concrete containment of the reactor building. Various safety and emergency cooling systems are part of the design.

Used fuel and other nuclear wastes currently in storage at nuclear stations also have to be managed carefully for eventual disposal. Used fuel is stored at nuclear stations until it can be transported to a disposal facility. Hydro is supporting the development of the Canadian disposal concept for used fuel coordinated by Atomic Energy of Canada Ltd. through the Canadian Nuclear Fuel Waste Management Program. This concept would encapsulate fuel in long-lasting containers to be sealed in a vault deep in the stable rock of the Canadian shield. The concept is currently being reviewed by the Federal Environmental Assessment and Review Process. Government and public reviews and approvals are required before a facility is sited and operational.

C. Major Purchases

Another major supply option is a purchase from a major utility outside the province. The 1989 Demand/Supply Plan already included a major purchase from Manitoba Hydro.

SELECTING THE OPTIONS

Having defined future requirements by forecasting demand and determined the ability of the existing system to meet those requirements, Hydro's planning approach is to call on the options in order of priority:

First, develop *Demand Management* that is economic and achievable;

Next, make *Non-utility Generation* purchases as required, provided that those purchases are economic compared to building major supply, and giving a preference to generators using renewable resources or efficient cogeneration; and, develop economic *Hydraulic* Generation taking into account environmental, aboriginal, and community concerns.

Last, develop *Major Supply* options that are most suitable for meeting customer needs.

Criteria for evaluating and selecting options are the following:

- customer satisfaction
- reliability standards
- worker and public safety requirements and standards
- environmental requirements and standards
- low cost of electricity service
- social acceptance
- technical soundness
- flexibility
- resource preferences
- diversity
- resource smoothing
- environmental characteristics, beyond requirements and standards
- public safety characteristics beyond requirements and standards
- economic impact
- other social considerations

THE 1989 PLAN AND APPROVALS REQUESTED

Using the planning strategy and options available to Hydro at the time, the 1989 Demand/Supply Plan proposed a 25-year plan that would rely on a mix of demand management, non-utility generation, transmission (to carry the Manitoba purchase), gas-fired CTUs (some of which would be convertible to IGCC), hydraulic generation, and CANDU nuclear stations.

The 1989 Demand/Supply Plan was submitted to the provincial Environmental Assessment Board. (See Section V for a discussion of the formal EAB process and public review activities.) Hydro sought approvals relating to the need for certain components of the Plan, namely, hydraulic, fossil and nuclear generating stations, and a transmission line in northern Ontario to incorporate the Manitoba purchase.

Other components of the Plan do not require approval, for example, demand management programs, purchases from independent power producers, and rehabilitation work on existing stations.

Approvals were sought based on a five-year Action Plan. The action plan included facilities for which a project environmental assessment document would be submitted within five years of an Environmental Assessment Board decision on the Demand/Supply Plan.

III Updates to Elements in the 1989 Demand/Supply Plan

INTRODUCTION

The options that Ontario Hydro intends to rely on to supply the Province of Ontario with its electricity needs into the next century are similar to the ones proposed in its original submission in December of 1989. What has changed is a deferral of need for major supply reflecting a combination of increased demand management, and a reduced demand for electricity in the short term as a result of the downturn in the economy.

There is also a reduction of longer-term requirements due to life extensions and the potential availability of economic non-utility generation, as well as further development of demand management.

Two developments in particular have led to the increased demand management targets. There is the prospect of greater opportunities for demand management through higher electrical efficiency standards from the government. In addition, new legislation will provide the opportunity to promote alternative fuels in applications where electricity is not the most appropriate energy and where there are benefits to the customer and to Hydro. With these developments, the higher targets for demand management flow from the planning strategy for the 1989 DSP which said that Hydro would get the most demand management that is practically and economically achievable. This change *does not* reflect a reduction in energy service to the customer; it means the same service with less electricity.

The 1989 plan also identified as a priority maximizing the use of the existing system. Hydro is now planning to extend the life of several of it fossil burning stations.

Non-Utility generation is also now forecast to be able to provide more of the Province's electrical needs than originally foreseen.

The development of the remaining economic hydraulic potential remains a priority option, but Hydro has recognized changes in relations with aboriginal peoples. The hydraulic plans that Ontario Hydro has incorporated into the UPDATE take into account the special interests of the aboriginal community.

The overall result of these changes has required an update to Hydro's proposal – even though the revised median forecast (which takes into account the effects of fuel switching and higher standards) is still within the range of probability defined in the original 1989 submission.

Although the need for major supply is significantly deferred, those options, including fossil and nuclear facilities, and purchases,

Figure 5 **Options to Meet Demand by 2014**

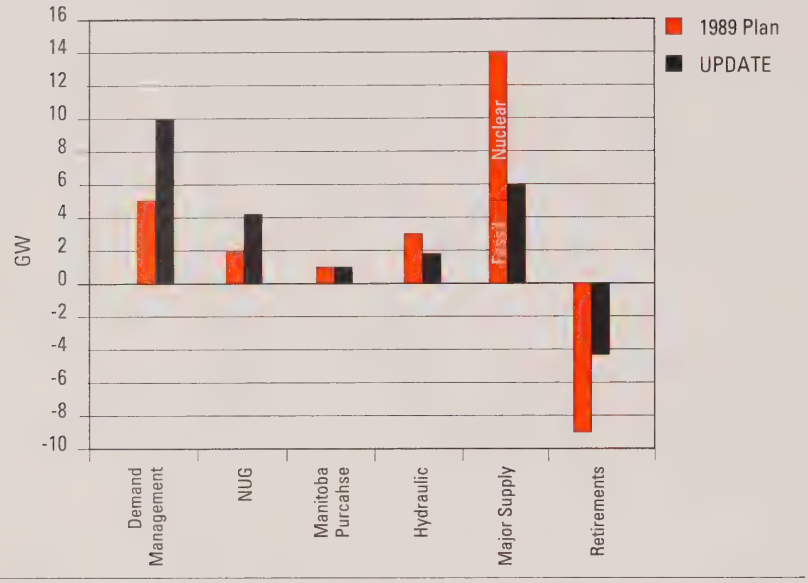
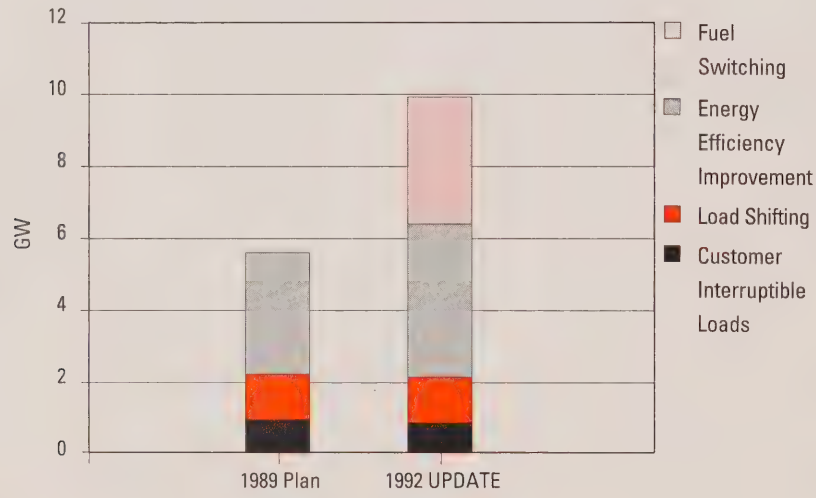


Figure 6 **Electricity Savings by the Year 2014**



should remain open for future consideration. In addition, other supply options are also being studied to see if contributions can be made from non-traditional sources such as fuel cells.

MORE ELECTRICITY SAVINGS

One of the most ambitious energy savings programs in North America will help Ontario's electricity customers (residential, commercial, agricultural and industrial) get the best value for their energy use.

Ontario Hydro offers incentives to users and manufacturers of electrical appliances and equipment to promote more efficient products. The process of adopting more efficient equipment can be accelerated through government legislation. Hydro is working with government to implement higher electrical efficiency standards in many areas as well as energy efficient building codes.

In June of 1991 the Provincial Government announced that it was proposing changes to the Power Corporation Act which is the main governing piece of legislation for Ontario Hydro. Proposed changes would allow Hydro to promote alternative forms of energy (sometimes known as "fuel substitution" or "fuel switching") where it is in the customer's and Hydro's interest to do so.

An example of this would be to convert houses heated with electrical forced air furnaces to natural gas furnaces. This will reduce customers' heating costs.

These changes have allowed Ontario Hydro to raise its forecast of savings as a result of demand management measures from 5,570 MW to 9,860 MW by 2014. This increase in demand management savings helps defer the need for major supply options.

GETTING MORE USE FROM THE EXISTING SYSTEM

Ontario Hydro's existing generating stations will still meet most of the requirements for electricity over the next 25 years. As with any equipment, components do wear out and need to be replaced. When Ontario Hydro developed the original Demand/Supply Plan it assumed that about one-fourth of the existing system would be retired by the end of the forecast period. This need to replace retiring generation capability was a significant factor in the need for new stations.

The UPDATE now assumes that Hydro's newer existing fossil stations can have their useful lives extended past their 40 year retirement date. There is increasing confidence that the life extension of fossil plants can lead to economic benefits. With life extension of fossil stations it is also planned to install additional environmental control equipment. Hydro would start in the near term to increase capital and operating and maintenance expenditures to ensure that the facilities will continue to be productive past their original retirement date.

With the extension of the life of fossil stations it is now expected that by 2014 about 4,300 MW of capacity that would have been lost through retirements will continue to generate economically, efficiently and in a way that meets high environmental standards. Continued use of this capacity defers the requirement for new major supply options.

CONTRIBUTION FROM NON-UTILITY GENERATION

Hydro has been placing increased emphasis on non-utility generation since the early 1980s. Policies, purchase rates, contractual conditions and connection requirements were developed. These activities contributed to a growing non-utility generation industry.

Non-Utility Generators were looked to in the original submission to provide 2,120 MW of capacity to help meet Hydro's requirements by the year 2014.

Potential contribution from this source is forecast now to be higher, up to 4,200 MW of power by 2014, if needed. How much and how fast the potential from non-utility generation will be realized will depend on Hydro's on-going requirements.

Preference is given to non-utility generators that use efficient cogeneration or renewable (hydraulic) or waste resources. These tend to be medium to small projects that reflect the cogenerator's need for process steam or supply of waste fuel. Power from large scale fossil-fuelled generating stations to meet electricity demand will continue to come from Ontario Hydro's own plants.

Getting the most from Hydro's existing stations remains a priority, and much of Hydro's requirements over the short and medium term might be met more economically through Hydro's own fossil stations. Because non-utility generation is a flexible option with short lead times, it makes sense to utilize its potential in accordance with net requirements once contributions from demand management and Hydro's own stations are taken into account.

CHANGES TO THE HYDRAULIC PLAN

The 1989 Demand/Supply Plan projected that 2,850 MW of new hydraulic capacity could be economically developed by the year 2014.

Hydro's planning approach identified hydraulic as a priority option. However, since the 1989 Plan, the relationship between the Ontario Government and the First Nations in Ontario, and the relationship between Hydro and aboriginal peoples have evolved.

As a result, Hydro officially suspended planning for six new stations and two extensions to existing stations on the Moose and Abitibi Rivers until a process for co-planning studies related to Hydro developments in that Basin has been agreed to by the affected aboriginal groups.

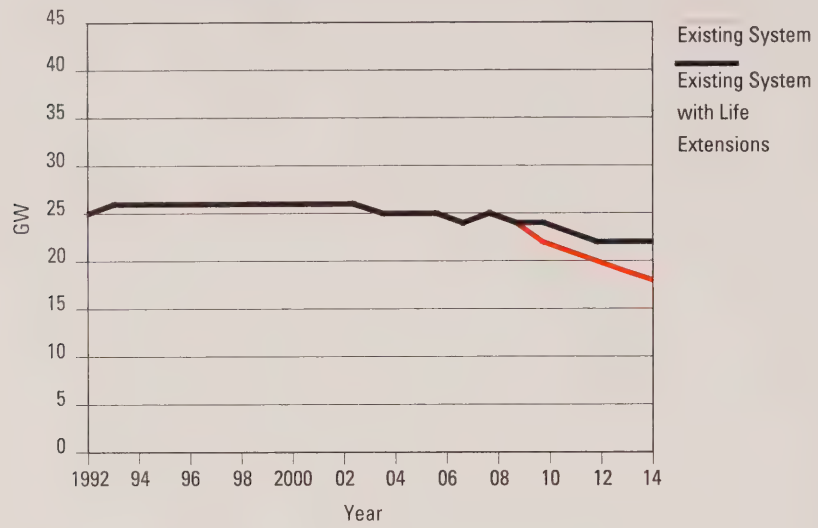
Primarily as a result of these changes, Ontario Hydro estimates that up to 1,800 MW of additional hydraulic capacity can be relied on for planning to 2014, and approvals are being requested consistent with this estimate.

DEFERRED REQUIREMENTS FOR MAJOR SUPPLY OPTIONS

The original DSP submission included requests for approval of the need for two nuclear stations, a number of natural gas-fired combustion turbine units, some of which could be converted to combined cycle or coal gasification units at a later date, and a major transmission line to carry purchased power from Manitoba.

In the UPDATE, Ontario Hydro is requesting the approval for the requirement and rationale for the transmission facilities to incorporate the Manitoba purchase. The purchase will provide approximately 1,000 MW starting in 2000.

Figure 7 **Capability of the Existing System to Meet Demand**
with Life Extensions



The downturn in the economy means that in the short term there is less urgency for new supply. The forecast, after allowing for the effects of more demand management, also indicates a need for approximately 6,000 MW of additional major supply by the year 2014, with the first plants coming into service about 2009-2011.

These developments mean that the need date for major supply has been deferred beyond the point where it is necessary to request approvals at this time.

Major supply options for the future are nuclear, fossil (natural gas, coal and oil) and future major purchases. In the past, nuclear stations in Ontario have generally been built as four-unit (4x880 MW) stations. In the future, different sizes and configurations would be considered.

IV THE PLAN UPDATE

INTRODUCTION – ELEMENTS OF THE PLAN UPDATE

In summary the main features of the UPDATE plan are;

- increased use of demand management due to greater opportunities,
- effective use of the existing system, including the life extension of fossil generation and the timely retrofit of improved environmental controls to life extended fossil plants,
- use of non-utility generation as required,
- proceeding with a reduced amount of hydraulic development,
- development of transmission to incorporate the power already contracted from Manitoba, and
- deferral of major supply.

The hydraulic capacity is expected to be added to the system (subject to project specific environmental assessment approvals) over the period 1997 through to 2008. The Manitoba purchase will start delivering power to Hydro's grid by the year 2000 provided timely transmission approvals are obtained.

The approvals amount to 2,800 MW of new capacity. The updated plan involves about $7 billion in investment in new facilities. In addition, Hydro is investing $6 billion in demand management over the 1990s.

Figure 8 summarizes the changes in Hydro's 25 year plan. Figure 9 summarizes the changes in the near-term Action Plan and the approvals requested.

PLAN UPDATE IMPACTS

Environmental Impacts

Ontario Hydro's reliance on demand management, non-utility generation and hydraulic generation help to reduce the need for major supply options and their associated environmental impacts.

Furthermore Hydro is planning additional environment control measures to existing stations to mitigate impacts.

Environmental regulations will likely become more stringent over the planning period. Extending the lives of fossil stations will be accompanied by improved environmental controls such as combustion process modifications (CPM) and selective catalytic reduction (SCR) units for controlling NO_x air emissions.

Figure 10 shows how the number of fossil units that are planned to be fitted with

Figure 8 **Hydro's 25 Year Plan**

	The 1989 Plan		1992 UPDATE	
Option	*Additional Amounts by 2014*	*Retirements by 2014*	*Additional Amounts by 2014*	*Retirements by 2014*
Demand Management	5,570 MW		9,860 MW	
NUG	2,120 MW		4,200 MW	
Manitoba Purchase	1,000 MW		1,000 MW	
Hydraulic	2,849 MW		1,800 MW	
Fossil	5,376 MW	6,654 MW	[6,000 MW of major supply	2,366 MW
Nuclear	8,810 MW	2,060 MW	[required by 2014	2,060 MW

Figure 9 **Hydro's 5 Year Action Plan and Request for Approvals**

	The 1989 Plan		1992 UPDATE
Options for Which Approval not Required			
Demand Management	Implement to achieve 5,570 MW by year 2014		Implement to achieve 9,860 MW by year 2014
Non-Utility Generation	Implement to achieve 2,120 MW by year 2014		Implement to achieve 4,200 MW by year 2014
Approvals Requested			
Option	*Capacity*		*Capacity*
Manitoba Transmission	1,000 MW		1,000 MW
Hydraulic Generation	2,010 MW	(up to)	1,800 MW
Major Fossil and Nuclear Supply			Need for Approvals Deferred
CTU	672 MW		
CTU	672 MW		
CTU/IGCC	2,016 MW		
CTU/CC	1,008 MW		
CANDU A	3,524 MW		
CANDU B	3,524 MW		

Figure 10 **Environmental Enhancements**
1989 Plan vs 1992 UPDATE

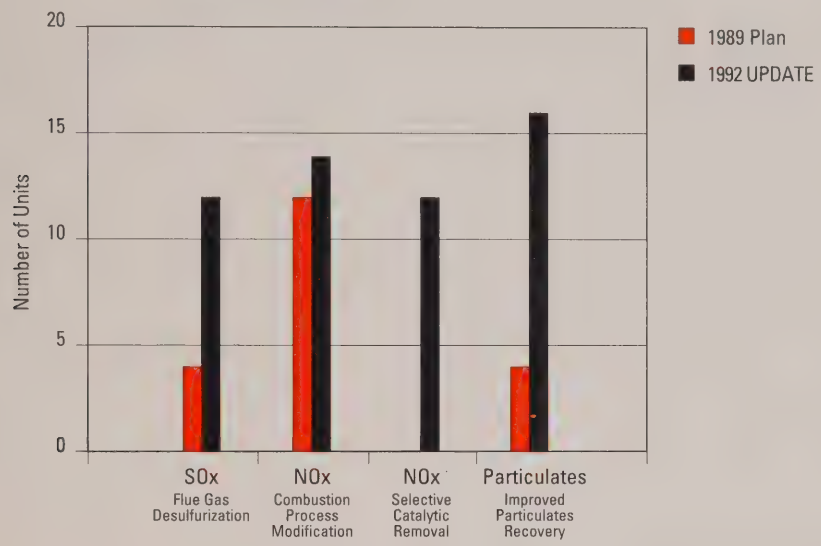
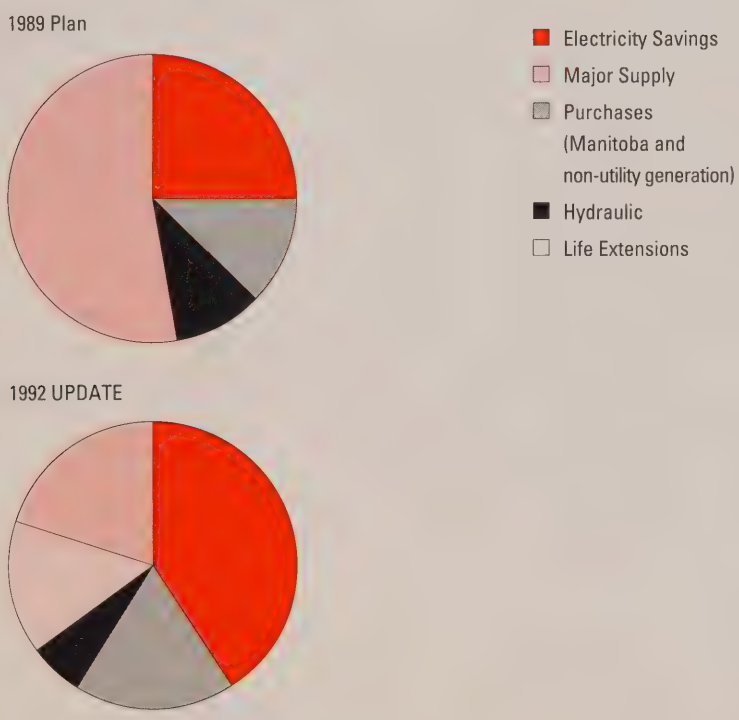


Figure 11 **Options to Meet Future Requirements by 2014**



improved environmental controls is increased over what was planned in the 1989 Plan. This would allow Hydro to meet stricter emission control regulations anticipated in the future. Other technologies will also be considered, and emission control technologies may be subject to environmental assessments.

Flue gas desulphurization (FGD), scrubbers, are planned for 12 units at major fossil burning plants. To control particulates, improved electrostatic precipitators or other measures will be implemented.

In the case of CO_2 emissions, there are no current regulations. However, a target of holding CO_2 and other greenhouse gases at 1990 levels by the year 2000 was endorsed by the Federal Government.

There is no current commercially available method of removing CO_2 form fossil emissions. At present the only way to reduce CO_2 is to reduce fossil burn, improve the efficiency of combustion, convert from coal to natural gas, or to substitute other forms of generation. Some mitigation measures such as tree planting can off-set CO_2 emissions.

NO_X controls in the form of combustion process modifications or SCRs are planned for installation at major fossil stations.

There are several approaches to reducing fossil emissions. One approach to controlling emissions is to use demand management to reduce the requirement for generation. Another approach is to remove emissions with environmental control technology. Another is to use cleaner fuels in fossil stations, for example low sulphur coal instead of high sulphur coal, or natural gas instead of coal. An additional approach is to use a different kind of generation altogether such as nuclear or hydraulic generation.

Ontario Hydro will be subject to environmental regulations of the Municipal Industrial

Strategy for Abatement (MISA). This strategy is aimed at eliminating the discharge of persistent toxic substances into water bodies. Hydro plans improved water treatment facilities at all stations.

If the new major supply is nuclear, the production of additional nuclear used fuel will have to be accommodated. Any proposed nuclear used fuel disposal facility would have to be able to accommodate used fuel from both existing and possible future new stations. The concept for such a facility is currently being reviewed through the Federal Environmental review process.

Financial Impacts

One of the critical aspects of the plan UPDATE is its effect on electricity prices or more specifically, its impact on the customer's electricity bill.

The higher targets for demand management and non-utility generation included in the UPDATE will defer the need for new major supply facilities in the long term. This approach will mean lower long term customer costs than relying predominately on major new supply.

Customers can also help manage their electricity costs by participating in demand management programs. A wide range of programs available to all types of customers can lower the amount of electricity they use for the same service.

Another important element of the financial outlook is the impact on the Corporation's borrowing requirements. Hydro's borrowing requirement is expected to range from $2 billion to $4 billion annually (in 1991$) for most of the next 15 years, rising to about $5 billion by the end of the planning period to fund construction of new major supply facilities. Under the current outlook, the borrowing requirement over the planning period is lower than that at the time of the original Plan by about $9 billion or 12%, largely due to the deferral of new supply.

DEALING WITH UNCERTAINTY

Hydro is confident that this updated plan will continue to deliver reliable power on demand to the province's 3.5 million electricity customers. The current most likely forecast indicates that Ontario will require additional supply (beyond the Manitoba purchase and the hydraulic projects) in the 2009-2011 time period.

In a period where rapid growth in demand over the short term looks probable, it would make sense to seek approvals, as the 1989 Plan did, based on the upper range of the forecast.

The circumstances of the UPDATE suggest that less supply will be needed, and later. There is the time and flexibility to respond to upper growth, should it materialize, with shorter lead time options such as purchases, CTUs, demand management programs, non-utility generation, and the use of stations currently out of service. It then becomes more realistic to request approvals based on planning around the median forecast, as the UPDATE has done.

There is uncertainty associated with any plan, especially one that has such a distant planning horizon as the Demand Supply Plan. This uncertainty requires that Hydro revisit the plan on a regular basis to ensure that the forecast and assumptions are still valid. Recognizing the continuous nature of planning is important both for Hydro, and for the ongoing public review of Hydro's plans.

The actual results will be monitored closely to ensure that appropriate actions are taken to ensure continued reliable electricity service. In this respect, Hydro's partnership with government, utilities and homeowners in meeting priority demand management objectives is critically important.

V PUBLIC REVIEW

FORMAL REVIEW: THE DEMAND/SUPPLY PLAN HEARING

The formal mechanism for reviewing the Demand/Supply Plan is a hearing before the provincial Environmental Assessment Board (EAB). In its 1989 application to the Board, Ontario Hydro as the proponent asked the EAB to rule on the requirement and rationale for a portion of the facilities associated with its 25 year plan – in particular for developing hydraulic generation, a transmission line to carry the power purchased from Manitoba, and a number of natural gas-fired units and other major supply facilities (fossil and nuclear).

The DSP hearing was asked to rule that there was a need, and that the proposed technologies were appropriate ways of meeting that need. For the projects to proceed, there would have to be, in addition to the DSP Hearing ruling, an environmental assessment on each project to determine the specific characteristics of the project and the suitability of the site. These project environmental assessments might also require a hearing.

Progress of the Demand Supply Hearing

- *December, 1989* – Ontario Hydro submits Demand/Supply Plan to Minister of the Environment.
- *January, 1990* – Minister of the Environment issues order requiring a hearing under the Environmental Assessment Act.
- *April, 1990* – The hearing begins to determine status of those groups and individuals wishing to participate in the hearing.
- *June, 1990* – Government Review of Demand/Supply Plan is released.
- *June, 1990-December, 1990* – Funding Panel awards over $23 million in funding to 29 intervenors in the hearing
- *April, 1991* – EAB begins to hear evidence from Ontario Hydro
- *December, 1991* – Evidence, including cross-examination, has progressed through six of Ontario Hydro's witness panels.

UPDATE to the Plan and Request for Approvals

Long-term plans have to be flexible enough to evolve with changing circumstances. Changes in circumstances and updates to specific components in the Demand/Supply Plan have required Hydro to integrate these adjust-

Hydro's Request for Approvals

The Environmental Assessment Board is reviewing Hydro's request for approvals for the need for facilities. A project-specific environmental assessment and review is needed to determine whether and where such facilities can be sited.

The Approvals that Hydro is requesting in the Environmental Assessment Board hearing are:

- The requirement and rationale for transmission to incorporate electricity purchased from Manitoba, and
- The requirement and rationale for up to 1,800 MW of hydraulic capacity.

In determining these approvals, the range of considerations before the EAB include:

- How much demand management, including fuel switching, is it appropriate to rely on for planning purposes?
- To what extent should reliance be placed on NUG, and priority be given to certain types of NUG such as cogeneration?
- Is there an adequate requirement and rationale for including a range of hydraulic capacity in electricity planning?
- Is there an adequate requirement and rationale for the transmission to incorporate the Manitoba Purchase?
- In electricity planning, what is the appropriate role of fossil generation, particularly with respect to reliance on natural gas, and with respect to greenhouse gases and related environmental considerations?
- In electricity planning, what is the appropriate role for the nuclear option, taking into account both its advantages and disadvantages?

How the Demand/Supply Plan Hearing Proceeds

The hearing has proceeded with Ontario Hydro presenting its evidence through, and being cross-examined on, six panels in sequence, each addressing a particular aspect of the Plan. The panels are:

Panel	
1	Economics and Forecasting Panel
2	The Existing System Panel
3	Costing Concepts and Avoided Cost Panel
4	Demand Management Panel
5	Non-utility Generation Panel
6	Hydraulic Generation Panel

Upcoming panels will address additional aspects including purchases and transmission, fossil generation, nuclear generation, major supply and integrated demand/supply plans.

Hydro calls on its witnesses to give evidence, and they are subject to cross-examination by intervenors in the Hearing on a panel-by-panel basis. After Hydro has completed its evidence in this way, the intervenors will call their witnesses, and they will likewise be subject to cross-examination by Hydro and other intervenors.

ments in an overall Plan UPDATE and the associated approvals sought.

Hydro is not withdrawing its application currently before the EAB. It is continuing to seek approvals based on a five-year Action Plan, and, on this basis, will continue to seek approval for the requirement and rationale for transmission associated with the purchase from Manitoba, and for up to 1,800 MW of hydraulic generation.

COMMUNICATIONS ABOUT THE DEMAND/SUPPLY PLAN

The development of the 1989 Demand/Supply Plan offered numerous opportunities for public and government input and review during key stages of the Demand/Supply Planning process. Figure 12 outlines the evolution from an initial study by Hydro of the options for meeting future needs, through consultation with provincial organizations and regional community leaders, review by government of the strategy, to the release of the Plan in December, 1989.

Following the Plan's release, public feedback activities included Plan information centres in over 70 communities, where more than 3,000 people responded to questionnaires about the Plan. These centres gave Ontarians a chance to ask questions about the Plan, and to express concerns and offer views.

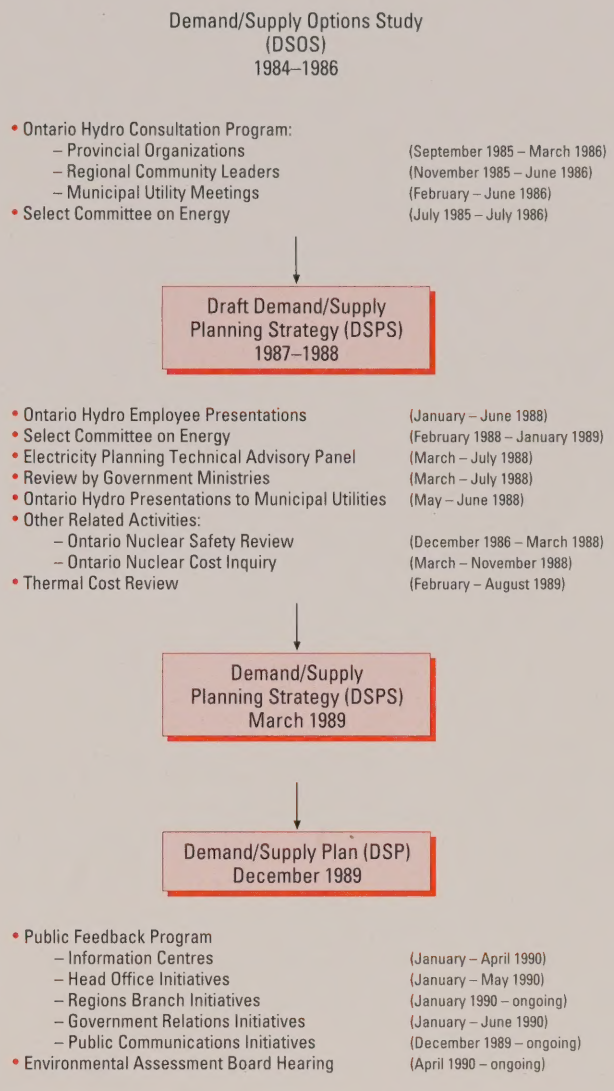
With the start of the Demand/Supply Hearing, there is now a formal review process by which the public can express their views, either directly or through one of the more than 150 groups and organizations that are participating in the Hearing.

Because planning is intended to serve electricity customer needs, keeping in touch with the public is a priority. With the release of this

UPDATE, Hydro will continue to respond to requests from groups and organizations for presentations or more detailed information.

For further information, or to order additional copies of this material, please phone toll-free 1-800-263-9000.

Figure 12 **Opportunities for Public and Government Review**

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